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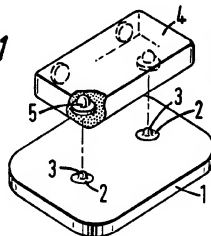
(56) Documents cited  
GB A 2016146 GB 1543441 US 3603881

(58) Field of search  
G1N

(54) **Sudden infant death syndrome monitor**

(57) A monitor unit for use with babies comprises a pair of electrodes 2 on a pad 1 attached to the baby's chest, a self-contained transmitter unit 4 mounted on the pad to emit a radio signal representing the heart beat rate and a remote receiver for the signal arranged to emit an alarm signal when the heart beat rate falls below and/or exceeds predetermined values. The unit 4 may be mounted on the pad 1 by studs 3 and sockets 5 and contain an ECG amplifier and an F.M. transmitter.

**FIG.1**



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FIG.1

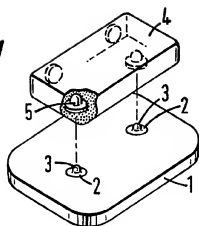


FIG.2

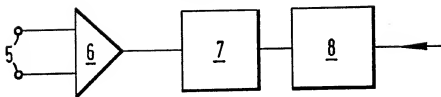
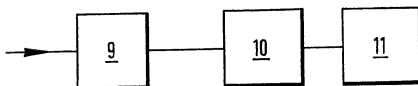


FIG.3



## SPECIFICATION

## Sudden infant death syndrome monitor

- 5 This invention relates to monitoring of infants especially for detection of sudden infant death syndrome.

Sudden infant death syndrome affects a significant percentage of new born infants.

- 10 Previous devices for monitoring this phenomenon have utilised breathing as a criterion. A small balloon under positive pressure is strapped to the infant's abdomen and the mechanical action of the baby's breathing is connected via a tube to a bedside monitor.
- 15 The infant's eeg (electrocardiogram) has also been used with traditional monitoring techniques to detect heart rate changes. Recent thinking indicates that a reduction in rate below certain set limits would provide an excellent alarm indicator giving timely warning of a possible catastrophic event.

- Both the traditional methods mentioned above are extremely sensitive to artifact. The mechanical device can generate a false alarm if the baby rolls over onto the pressure sensing bulb. The electrical detector using the traditional cable connection can become entwined around the child or be easily pulled off.

- The present invention is intended to provide a means for monitoring the behaviour of the baby's heart which allows the baby complete mobility while allowing a remote alarm to be actuated in the event of the heart beat rate exceeding or falling below set limits with a minimal risk of false alarms.

- According to one aspect of the invention there is provided a monitor unit suitable for use with young babies which comprises a pair of electrodes incorporated in an electrode pad suitable for attachment to a baby's chest, a transmitter unit mounted on the electrode pad arranged to receive electrical signals from the electrodes and transmit a radio signal containing these electrical signals, and a receiver unit arranged to receive the radio signal, detect the heart beat rate represented by the electrical signals and emit a warning signal if the heart beat rate is above or below predetermined limits.

- A monitor according to one embodiment of the invention will be described by way of example with reference to the accompanying drawings in which:

Figure 1 shows a transmitter unit forming part of the monitors,

Figure 2 is a block diagram of the transmitter unit of Fig. 1,

- 60 Figure 3 is a block diagram of a receiver unit forming part of the monitor.

- Referring to Fig. 1 of the drawing, an electrode pad 1 is made of electrically insulating foam plastics material and may be fixed to the chest of a baby by a strap, sticking plaster

or other means holding the pad firmly in place. The pad is provided with a pair of metal electrodes having contact surfaces flush with the bottom of the pad to make contact with the baby's body and receive the electrical signals representing the activity of the heart. The electrodes 2 extend through the pad and each has an upwardly projecting stud 3.

- An amplifier and transmitter unit 4 has dimensions of approximately  $5 \text{ cm} \times 2.5 \text{ cm} \times 1 \text{ cm}$  and has on its lower surface metal sockets 5 to receive the studs 3. The studs and sockets together form press-stud fasteners which secure the unit 4 to the pad.

- As indicated in Fig. 2 unit 4 contains an amplifier 6 connected to the sockets 5 to receive and amplify the electrical signals received through the electrodes and amplify them to a suitable magnitude. Unit 4 also contains a frequency-modulated radio transmitter with a range of up to 7 metres connected to the amplifier and broadcast a radio signal modulated in accordance with the signals received from the amplifier. The radio transmitter comprises a crystal-controlled oscillator 7 and a frequency doubler 8. The amplifier and transmitter are powered by batteries within the unit 4.

- A receiver unit, shown in Fig. 3, comprises an aerial to receive the broadcast signal connected to a demodulator 9 arranged to feed the demodulated signal to a heart rate detector 10, which deduces from the demodulated signal the rate of heart beat as indicated by the electrical signals received by the electrodes 2. The heart rate detector is connected to an alarm unit 11 which is set to emit a visual or acoustic signal when the heart beat rate recorded falls below a predetermined value.

- The receiver unit will be placed sufficiently close to the baby to receive the transmitted signal and may be battery or mains powered. Frequency-modulated transmission is used in preference to amplitude-modulated transmission as it is less subject to interference.

- When a number of babies in a hospital ward are being monitored using monitors according to the invention the transmitters and respective receivers associated with each baby are set to operate at different transmission frequencies.

- The heart rate detector is set to actuate an alarm signal if the heart beat rate falls below a given value and it may also be set to actuate the alarm if the rate detected exceed another, higher, value.

## CLAIMS

1. A monitor unit suitable for use with babies which comprises a pair of electrodes incorporated in an electrode pad suitable for attachment to a baby's chest and a battery-powered transmitter unit mounted on the electrode pad arranged to receive electrical signals

from the electrodes and transmit a radio signal representing these electrical signals.

2. A monitor unit according to claim 1, in which the transmitter unit comprises an amplifier to receive electrical signals from the electrodes and a frequency-modulated radio transmitter connected to the amplifier, the radio transmitter comprising a crystal-controlled oscillator and a frequency doubler.

3. A monitor unit according to claim 2, in which the radio transmitter has a range of up to 7 metres.

4. A monitor unit according to any preceding claim, in which the electrodes are metal electrodes having contact surfaces to make contact with the baby's chest substantially flush with a surface of the pad, the electrodes pass through the pad, the transmitter unit being mounted on the opposite surface of the pad and connected to the electrodes by plug-and-socket connectors.

5. A monitor unit according to claim 4, in which the transmitter unit has dimensions of approximately  $5\text{ cm} \times 2.5\text{ cm} \times 1\text{ cm}$ .

6. A monitor unit according to any preceding claim, also comprising a receiver unit remote from the electrode pad and transmitter unit, the receiver unit being capable of receiving the radio signal from the transmitter unit and deduce from the signal the heart beat rate of the baby.

7. A monitor unit according to claim 6, in which the receiver unit is arranged to actuate an alarm device if the heart beat rate falls below a predetermined value and/or exceeds a predetermined value.

8. A monitor unit, substantially as hereinbefore described with reference to the accompanying drawings.